a conception favors the chemical theories of photosynthesis which assume that chlorophyll itself enters into the reactions, rather than those which assume that the synthetic reactions are performed externally to the chlorophyll by means of energy absorbed and transformed by the pigments.

That the light actually displaces electrons seems to be proved by DIXON and BALL[4], who show that the chlorophyll acts as a sensitizer of photographic films at the temperature of liquid air, a temperature believed to be too low for chemical reactions other than electronic displacement. They suggest that chlorophyll α and β might have an important connection in the synthetic process, as indicated by the following equations:

$$\underset{\text{(chlorophyll }\alpha)}{C_{55}H_{72}O_5N_4Mg}+CO_2\rightarrow\underset{\text{(chlorophyll }\beta)}{C_{55}H_{70}O_6N_4Mg}+HCHO$$

$$\underset{\text{(chlorophyll }\beta)}{C_{55}H_{70}O_6N_4Mg}+H_2O\rightarrow\underset{\text{(chlorophyll }\alpha)}{C_{55}H_{72}O_5N_4Mg}+O_2$$

The fact that *in vitro* experiments with chlorophyll α and CO_2 do not yield formaldehyde could be explained by accepting WILLSTÄTTER's assumption that before the CO_2 will react with the chlorophyll it must first be combined into a carbamino acid, which can then be decomposed by the reactive group in the chlorophyll, which group was rendered reactive by the electronic shifting due to light.

Regardless of whether the discovered facts are sufficient to establish the relations between electronic displacements and synthesis of carbohydrates, the attempt made by the authors to carry over into physiological interpretations the newer conceptions of electron chemistry is praiseworthy, and will be followed with great interest by physiologists. Ultimately all the chemical processes of life must be interpreted along similar lines.—C. A. SHULL.

The mycoplasm theory.—In two brief notes in English and an extended discussion in German, ERIKSSON[5] makes a spirited defense of his mycoplasm theory. Only incidental reference is made in these papers to the work on the grain rust, on which the theory was established, but the previously published conclusions on the downy mildew of spinach, the late blight of potato, and the hollyhock rust are reaffirmed, critics are replied to, not without acerbity, and in the case of the hollyhock rust new observations and experiments are adduced which, the author believes, still further support his hypothesis, of which he is not only the originator, but has been, to date, almost the sole protagonist. In

[4] DIXON, HENRY H., and BALL, NIGEL G., Photosynthesis and the electronic theory. II. Notes Bot. School, Trinity Coll., Dublin **3**:199–205. 1922.

[5] ERIKSSON, JAKOB, The mycoplasm theory, is it dispensable or not? Phytopath. **11**:385–388. 1921.

———, The life of *Puccinia malvacearum* Mont. within the host plant and on its surface. Phytopath. **11**:459–463. 1921.

———, Das Leben des Malvenrostpilzes (*Puccinia malvacearum* Mont.) in und auf der Nährpflanze. Handl. Kungl. Svensk. Vetensk.-Akad. **62**[5]:1–190. *figs. 31*. 1921.

the first paper he lists additional pathogens which he believes have a mycoplasm stage in their life histories, making a total of fifteen rusts, four downy mildews, three powdery mildews, one slime mould, and the causal agent of tobacco mosaic for which this curious combination of host and fungous protoplasm is claimed as proved or suspected.

Additional data are presented which lead the author to reaffirm, with some modifications, his previously expressed belief in the physiological dimorphism of the teleutospores, as evidenced by their mode of germination; one sort, in moist air, giving rise to long hyphae terminating in chains of conidia; the other kind, under the same conditions, germinating in ordinary teleutospore fashion, producing basidiospores. The latter, on penetrating the host tissue, give rise at once to an intercellular mycelium from which new sori develop in a few days, and are therefore the agencies by means of which the rapid spread from plant to plant is effected. On the other hand, the conidia discharge their contents into a host cell, with the contents of which they form an intimate intracellular protoplasmic union, that is to say, a mycoplasm, which multiplies within the host, even entering the embryo, thus forming the hibernating stage of the fungus. In spring, with the renewal of growth in a dormant plant or the germination of a seed, the fungus element separates out from the mycoplasm, organizes an intercellular mycelium, and eventually produces sori. Numerous observations are reported tending to show that the rapid spread of the disease from plant to plant occurs only late in the year, when basidiospores are being produced, the summer (conidial) infections not appearing until the following season. A series of experiments is reported in which the host plants were watered with weak solutions of copper sulphate. This resulted in a perceptible diminution in the number of summer pustules which appeared, these being due, according to the view outlined, to the conidial infections of the previous year, the fungus wintering over within the host. The copper solution was of no avail against the late summer basidiospore infection. Endeavors to inject the copper solution into the leaves and stems were unsuccessful. Without attempting to summarize the voluminous data, it may be admitted that the evidence seems to favor the view that the fungus may winter over within the host tissues. This is by no means a proof, however, that it is in a state of mycoplasmic symbiosis with the host. Furthermore, it must be regarded as a serious oversight that no notice whatever is taken of the carefully planned experiments of BAILEY,[6] which seem to point very decidedly to conclusions quite opposed to those of ERIKSSON. Certainly the facts in the case must be explained, and the mycoplasm theory admittedly offers a theoretical explanation. The widespread opposition to it is based on the feeling that the facts may ultimately be accounted for satisfactorily without the theory. If this shall prove to be impossible, the mycoplasm theory offers itself as a working hypothesis, which, however, must be confirmed by far less ambiguous cytological evidence than has yet been presented before it can be regarded as established fact.—G. W. MARTIN.

[6] Ann. Botany 34:173–200. 1920.